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P^H, EC AND OC STATUS OF CHITTOOR DISTRICT SOILS OF ANDHRA PRADESH

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ABSTRACT

Analysis of 576 geo-referenced surface soil samples collected using stratified random sampling techniques from 64 mandals of Chittoor district of Andhra Pradesh. The pH of the soils was found to be in the range of 4.5 to 8.9 and majority of them (53%) were alkaline in nature. The EC of the district soils was normal and was in the range of 0.10 and 1.66 dSm^{-1}. Fifty five percent of soils analyzed from Chittoor district were found to be medium in organic carbon content (0.5 to 0.75%) and 43% registered low organic carbon content. The nutrient index rating for OC, therefore, was found to be medium (1.78). All the thematic maps related to studying P^H, EC and OC were prepared in a GIS environment and presented

KEYWORDS: P^H, EC & OC

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INTRODUCTION

Soil nutrient fertility assessment is an important prerequisite for scientific fertilizer recommendation and usage, both at micro and macro level. The validity and usefulness of generated soil fertility maps of an area depends upon the intensity of sampling done, methods of analysis and classes of fertility adopted, time lapse since its preparation and the backed-up fertilizer prescription accuracy for adoption by farmers. Unlike in the recent past, where soil fertility mapping is done manually, the kind of information derived from such fertility data now is enormous due to use of tools like GIS. This facility coupled with gathering of information such as coordinates of the sampled area with GPS is an additional feature to re-visit the places of sampling during re-assessments of fertility. The district of Chittoor in A P is one whose soil fertility mapping, especially for P^H, EC and OC was attempted for finding out the extent of the deficiency of Organic carbon in the soil of Chittoor district of Andhra Pradesh.

MATERIALS AND METHODS

Soil Sampling, Analysis and Preparation of Deficiency Maps

The methodology adopted was, about 7 to 10 soil samples were collected from each *mandal*. The samples were collected from cultivated lands on grid basis; as a result, the spatial coverage of survey area will be more. Accordingly, 576 soil samples were collected from 64 *mandal*s of 66 *mandal*s, present in the district. The depth of the soil sampling was 0-15 cm. The soil samples collected were processed and analysed for P^H, EC and OC. Nutrient index value calculated from the proportion of soils under low, medium and high available nutrient

categories, as represented by

$$NIV = \frac{[(P_H*3)+(P_M*2)+(P_L*1)]}{100}$$

The index values are rated in to various categories viz., high (>2.33), medium (1.66 - 2.33) and low (<1.66) for fertility rating [Ramamurthy and Bajaj 1969]. Simple correlations were carried out between the soil available micronutrients and soil properties to determine the relationship between these parameters using standard procedures at central computer facility of the university using in built software.

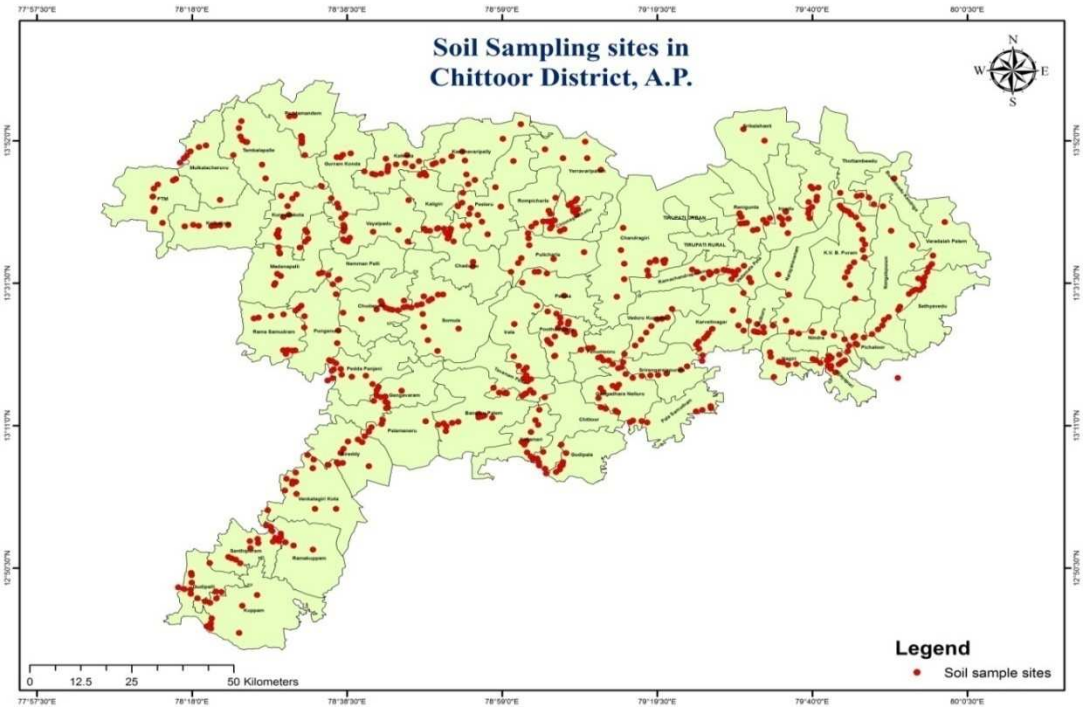

Figure 1: Soil Sampling Sites in Chittoor District, A.P

Soil Analysis

The Processed soil samples were analyzed for various soil characteristics by adopting standard procedures. The methods employed are described below:

Soil reaction (pH)

The pH of soil samples was determined in 1:2.5 soils: water suspension using a glass electrode pH meter (Jackson, 1973).

Electrical Conductivity (EC)

The electrical conductivity of soil samples was determined in 1:2.5 soils: water suspension with conductivity meter (Jackson, 1973) and is expressed as dSm^{-1}.

Organic Carbon

The organic carbon content of soil samples was determined by Chromic acid wet digestion method (Walkley and Black, 1934) and expressed as percentage.

RESULTS AND DISCUSSIONS

pH

The pH of soil samples analyzed in the district ranged from 4.5 to 8.9 (Table 4.1). Thus, the soils of the district were found to be acidic to alkaline in reaction. The pH of the soils was categorized into acidic, neutral and alkaline. It was found that about 53 per cent of district soils (304 samples) were alkaline in nature, 35 per cent were found to be neutral and rest of them are acidic. Completely alkaline soils were observed in *mandal*s like Chandragiri (rural), Palasamudram and Vadamalapeta. More than 50 per cent of soils analyzed from *mandal*s like Kaligiri and Gurramkonda were found to be neutral in reaction. Majority of soils in *mandal*s of Ramakuppam were found to be acidic in reaction (Table 4.1). The soil with lowest pH was recorded in a Nemmanpalli while that of highest (8.9) was in Penumuru *mandal*.

The pH of the soils of the district was mostly neutral to slightly alkaline in reaction with limited number of samples in the acidic range. Majority of the soils in the district were red with varying texture (Table 3.1). These soils are derived from granite. Therefore, such pH of the soils was expected. Ramana Reddy *et al*, 2013 have reported the similar pH range of the soils in the adjacent district of the YSR Kadapa which is in continuation of the district in terms of parent material and irrigation facilities. They have reported that 51 per cent of the YSR Kadapa district soils pH was in the range of 7.4 to 7.6.

Electrical Conductivity

The electrical conductivity of analyzed soil samples of Chittoor district was observed to be between 0.10 and 1.66 dS m^{-1} with a mean of 0.30 dS m^{-1}. It was observed that only one soil out of 576 was found to register EC of 1.66 dS m^{-1} and otherwise the EC of district soils did not record it beyond 0.58 dS m^{-1} (Table 4.1). The soils of Chadumu *mandal* alone in the district recorded mean EC of 0.84 dS m^{-1}. Thus, it is inferred that the soils of cultivated fields of Chittoor district do not suffer from any salt content problems as of now. The district has neither major rivers of perennial nature nor any irrigation canals to influence the soluble salt content of the soils in general.

Organic Carbon (%)

The mean organic carbon content of district soils was found to be 0.53 per cent in the range of 0.10 to 1.10%. Out of 576 soil samples of the district, 194 (43%) were found to be low in organic carbon content whereas most of the soils (55%) were medium in it. Only 66 samples in the district recorded high organic carbon content. The organic carbon content of all soils analyzed from Sathyavedu *mandal* and that of 90 per cent samples of Vayalapadu *mandal* was found to be low. On the other hand, more than 85 per cent soil samples analyzed from Irpedu and Buchinadu kandriga *mandals* registered high organic carbon content (Table 1).

The NI value computed for organic carbon content of soils of Chittoor was found to be medium with a value of 1.78. The NI value of organic carbon for different *mandal*s ranged from 1.0 to 2.89. Reflecting the trend of extent of low, medium and high categories of organic carbon content in the district, 28 per cent of *mandal*s of the district registered low NI, 66 per cent in medium NI and rest in high NI category. The NI map generated for Chittoor district is given in Figure 2.

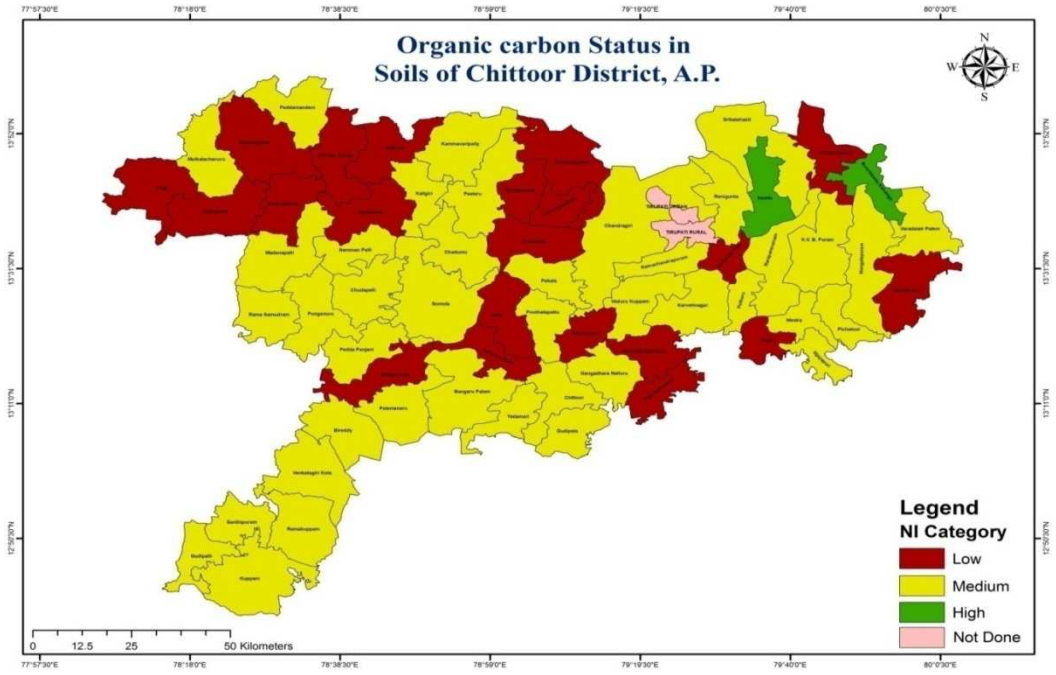

Figure 2: Organic Carbon Status in Soils of Chittoor District, A.P

The correlation coefficients worked out for organic carbon content of Chittoor soils with other characteristics was found to be significantly and positively correlated with EC (0.108*). The low organic carbon in the soils of Chittoor district may be due to low input of organics and also the rapid rate of decomposition because of high temperature prevailing in the district.

Table 1: Soil Organic Carbon Status (%) in Different *Mandal*s of Chittoor District of Andhra Pradesh

S NO	Name of the *Mandal*	No of samples	Status		Sample no. in Category			Nutrient Index	
			Range	Mean	Low	Medium	High	Value	Rating
1	Bangaru Palem	10	0.14-0.77	0.52	3	6	1	1.80	Medium
2	Bireddy	10	0.20-0.79	0.57	2	7	1	1.90	Medium
3	Bucchinadu Kandriga	7	0.18-0.80	0.58	0	1	6	2.86	High
4	Chadumu	9	0.12-0.87	0.64	2	2	5	2.33	Medium
5	Chandragiri	8	0.27-0.87	0.59	3	2	3	2.00	Medium
6	Chinnagottikallu	9	0.38-0.67	0.52	4	5	0	1.56	Low
7	Chittoor	9	0.24-0.66	0.50	3	6	0	1.67	Medium
8	Chudapelli	10	017-0.80	0.53	3	6	1	1.80	Medium
9	Gangadhara Nelluru	10	0.15-0.83	0.55	3	5	2	1.90	Medium
10	Gangavaram	10	0.22-0.66	0.51	4	6	0	1.60	Low
11	Gudipala	7	0.16-0.47	0.53	2	5	0	1.71	Medium
12	Gudipalli	8	0.12-0.82	0.48	3	4	1	1.75	Medium
13	Gurram Konda	10	0.37-0.54	0.47	5	5	0	1.50	Low
14	Irala	10	0.24-0.67	0.52	4	6	0	1.60	Low
15	Irpedu	9	0.18-0.81	0.53	0	1	8	2.89	High
16	K.V. B. Puram	9	0.10-0.74	0.53	2	7	0	1.78	Medium
17	Kaligiri	6	0.12-0.79	0.49	2	3	1	1.83	Medium
18	Kalkada	14	0.25-0.68	0.50	6	8	0	1.57	Low
19	Kammavaripally	11	0.22-0.84	0.61	2	5	4	2.18	Medium
20	Karvetinagar	10	0.20-0.82	0.58	3	2	5	2.20	Medium

Table 1: Contd.,

21	Kothakota	10	0.38-0.69	0.49	6	4	0	1.40	Low
22	Kuppam	10	0.12-0.70	0.50	3	7	0	1.70	Medium
23	Kuravalakota	10	0.25-0.63	0.48	4	6	0	1.60	Low
24	Madanapalli	10	0.41-0.74	0.59	1	9	0	1.90	Medium
25	Mulkalacheruvu	10	0.42-0.79	0.62	3	5	2	1.90	Medium
26	Nagiri	8	0.13-0.67	0.49	3	5	0	1.63	Low
27	Nangalapuram	8	0.11-0.76	0.55	2	5	1	1.88	Medium
28	Narayanavanam	7	0.35-0.61	0.52	2	5	0	1.71	Medium
29	Nemman Palli	7	0.16-0.65	0.52	2	5	0	1.71	Medium
30	Nindra	8	0.19-0.77	0.55	3	3	2	1.88	Medium
31	Pakala	8	0.24-0.66	0.52	2	6	0	1.75	Medium
32	Pala Samudram	8	0.22-0.63	0.49	3	5	0	1.63	Low
33	Palamaneru	8	0.16-0.79	0.55	2	4	2	2.00	Medium
34	Pedda Panjani	10	0.44-0.67	0.56	2	8	0	1.80	Medium
35	Peddamandem	10	0.31-0.74	0.53	3	6	1	1.80	Medium
36	Peeleru	10	0.16-0.83	0.57	3	3	4	2.10	Medium
37	Penumooru	10	0.10-0.70	0.47	4	6	0	1.60	Low
38	Pichatoor	7	0.14-0.67	0.53	1	6	0	1.86	Medium
39	Poothalapattu	10	0.20-1.10	0.55	4	5	1	1.70	Medium
40	PTM	10	0.32-0.70	0.52	5	5	0	1.50	Low
41	Pulicharla	9	0.32-0.68	0.47	6	3	0	1.33	Low
42	Punganuru	10	0.48-0.73	0.60	1	9	0	1.90	Medium
43	Puthuru	7	0.27-0.74	0.53	2	5	0	1.71	Medium
44	Rama Samudram	7	0.38-0.74	0.57	2	5	0	1.71	Medium
45	Ramachandrapuram	8	0.32-0.79	0.60	1	6	1	2.00	Medium
46	Ramakuppam	8	0.12-0.78	0.52	2	5	1	1.88	Medium
47	Renigunta	9	0.52-0.68	0.59	0	9	0	2.00	Medium
48	Rompicharla	7	0.43-0.57	0.49	4	3	0	1.43	Low
49	Santhipuram	9	0.16-0.82	0.56	3	3	3	2.00	Medium
50	Sathyavedu	6	0.15-0.48	0.37	6	0	0	1.00	Low
51	Somula	11	0.25-0.91	0.63	3	4	4	2.09	Medium
52	Srikalahasti	8	0.33-0.76	0.57	1	7	0	1.88	Medium
53	Srirangarajapuram	10	0.34-0.57	0.48	6	4	0	1.40	Low
54	Tambalapalle	10	0.31-0.68	0.54	4	6	0	1.60	Low
55	Tavanam Palle	10	0.10-0.61	0.44	4	6	0	1.60	Low
56	Thottambeedu	8	0.38-0.65	0.53	3	5	0	1.63	Low
57	Vadamala Peta	10	0.48-0.68	0.48	5	5	0	1.50	Low
58	Varadaiah Palem	8	0.38-0.66	0.56	2	6	0	1.75	Medium
59	Vayalpadu	10	0.32-0.54	0.40	9	1	0	1.10	Low
60	Veduru Kuppam	10	0.38-0.64	0.51	3	7	0	1.70	Medium
61	Venkatagiri Kota	10	0.19-0.87	0.62	3	2	5	2.20	Medium
62	Vijayapuri	9	0.16-0.73	0.55	2	7	0	1.78	Medium
63	Yedamari	8	0.12-0.87	0.47	3	4	1	1.75	Medium
64	Yerravaripalem	9	0.31-0.63	0.47	5	4	0	1.44	Low
District Status		**576**	**0.10-1.10**	**0.53**	**194**	**316**	**66**	**1.78**	**Medium**

CONCLUSIONS

Generalized nutrient recommendations over large areas may lead to the possibility of over or under use of P^H, EC

and OC with adverse economic and environmental challenges. The precision nutrient management concept is expected to provide ways to suitable micronutrient management. GIS maps based on intensive soil sampling are useful to assess variability in distribution of native P^H, EC and OC and in developing site-specific management practices for optimizing yield without any adverse effect on environment. The frequency distribution of micronutrients would further, aid in developing precise recommendation based on native nutrients status and crop need. Soil P^H, EC and OC maps would be highly useful in improving our understanding regarding native and extent of P^H, EC and OC problems and this can aid in developing appropriate P^H, EC and OC management strategies leading to better yield and environmental stewardship, which ultimately would be helpful in determining their relationship with animal and human health.

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